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(56) Documents Cited

GB 1416947 A

EP 0553558 A1

WO 95/16165 A1

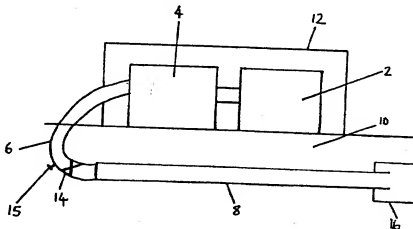
(58) Field of Search

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INT CL⁶ B05C 9/12 9/14 , B05D 7/22 , B29C 63/26
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(54) Abstract Title

Lining an enclosure and curing the lining

(57) A method for forming a polymer lining inside an enclosure, e.g. a pipe 8, comprises applying to the internal surface of the enclosure a curable lining composition and to reduce the curing time, heating the curable lining by means of a gas which has been heated by increasing its pressure. The heated gas may be supplied by means of a blower 4, there being a line 6 connecting the blower 4 to the enclosure and there being a constriction in the line, e.g. a valve 14, to cause heating of the gas.

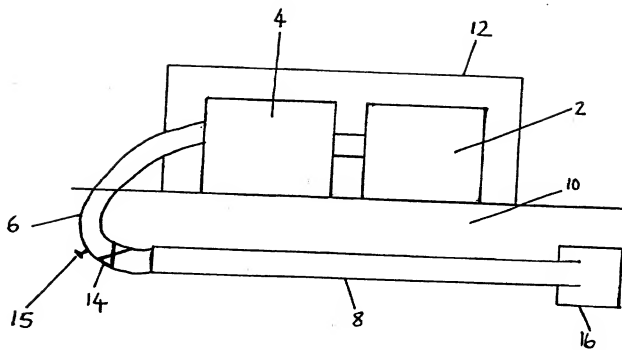


At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

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**A METHOD OF FORMING A COATING IN AN ENCLOSURE
AND AN APPARATUS THEREFOR**

Field of the invention.

5 This invention relates to a method for forming a polymer lining inside an enclosure, particularly a pipe and to an apparatus for use in the method.

Background of the invention.

10 Pipes which are intended to carry drinking water from a reservoir to individual premises are usually coated internally with a material to prevent corrosion and reduce the risk of contamination. Materials which have been previously used for this purpose include polyurethane and epoxy resins. An example of the latter is the epoxy resin sold under the Trade Name "Nitoline W P". The polymer lining is usually applied by spraying.

Problem to be solved by the invention.

15 Such resins take a significant time to cure, often in excess of 16 hours, and the pipe cannot be used until the curing has been completed. This delay is undesirable and may furthermore cause complications towards the end of the week because the curing time may run into the weekend where working is difficult or expensive.

20 There have been previous proposals to assist curing of the resin by means of heated air, for example GB Patents Nos. 2,218,773A and 2,106,009A.

The present invention provides a solution to this problem by a method which supplies a heated gas to the resin to accelerate the curing reaction and avoids the use of heaters and other expensive equipment.

Summary of the Invention.

According to the present invention a method for forming a polymer lining inside an enclosure comprises applying to the internal surface of the enclosure a curable
5 lining composition characterised in that to reduce the curing time the lining composition is heated by means of a gas which has been heated by increasing its pressure.

Advantageous Effect of the Invention.

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The application of heat to the polymer accelerates the curing reaction and thereby shortens the time taken for the curing to be completed. This means that in the case of a pipe for example, the pipe can be brought into use for the transport of water with less delay.

15 **Detailed description of the Invention.**

The lining composition may be a resin such as a polyurethane or an epoxy resin.

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The resin may be applied to the internal surface of the enclosure by spraying by means of an apparatus described in the following patents GB Patent 2,160,289B or WO 97/06382 or GB 2,226,865A.

The resin may be aneorobically curable or curable by light as disclosed in GB 2,226,865A.

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After application of the resin to form the lining on the internal surface of the enclosure, the resin is preferably heated so that its temperature is about 15 to 110, more preferably 20 to 60, most preferably 40 to 50 degrees Centigrade above the ambient temperature which is typically about 7 to 10 degrees Centigrade.

The most preferred temperature range inside the pipe is therefore from about 40 to about 60 degrees Centigrade.

5 Preferably the heat is applied by supplying a gas, conveniently air e.g. by blowing, to the inside of the enclosure. In the case of a pipe a constriction may be placed in the pipe at some distance from the point at which the gas is introduced to increase the heating effect. Conveniently the constriction is near an end remote from the point of introduction of the gas.

10 One method of heating the curable polymer lining comprises supplying unheated air (or air which is no more than 10 or 5 degrees Centigrade above the ambient temperature) to the enclosure and providing a restricted exit for the air, for example in the case of a pipe a constriction is provided in the pipe at a point spaced apart from the point of introduction of the air. This constriction causes an
15 increase in pressure and temperature.

Alternatively and preferably however, the constriction eg in the form of an adjustable valve is located between the blower and the pipe, for example in the hose connecting the blower and pipe, to increase the pressure and hence the temperature of the gas entering the pipe. The advantage of this arrangement is
20 that no pressuring of the pipe itself takes place and it also allows for most of the equipment to be located at one end of the pipe.

Preferably the rate of supply of air in relation to the size of the pipe and the constriction is such as to cause in an increase in pressure inside the pipe of about 0.25 to 2 bar more preferably from 0.5 to 1 bar.

25 The equipment for providing the air may be one that is known as a blower and a suitable such blower is the "Wade Blower" which is available commercially from Adams Ricardo Ltd, Millbrook Road, Stover Trading Estate, Yate, Bristol BS 17 5PB.

Preferably the internal surface of the pipe is dried before the application of the resin lining. It has been found that moisture left in the pipe can cause blistering of the lining. Removal of this moisture before the application of the resin avoids this problem.

The drying can conveniently be effected by passing air through the pipe, for example by means of the blower referred to above. Heated air may be used, although it is not necessary to increase the temperature inside the pipe. Unheated air may conveniently be passed through the pipe to effect the drying with or without the constriction in the pipe mentioned above.

According to another aspect of the invention there is provided an apparatus for the treatment of pipes and other enclosures to accelerate the curing of a polymer lining applied to the inside of the pipe which apparatus comprises

- (i) means for supplying air or other gas hereafter referred to as a blower
- (ii) a line for the supply of the air from the blower to the pipe and suitable for connection to the pipe said line being connected to the blower and
- (iii) a valve located in the line and arranged so that when air is supplied from the blower the pressure and temperature of the air inside the line is caused to increase and provide heated air to the pipe.

A means for removing moisture from the air may also be provided.

The means for removing moisture is preferably capable of removing at least 90%, more preferably 95%, most preferably 99% of the moisture in the air entering the blower. This is to avoid introducing moisture into the pipe with the air.

The apparatus may be provided with a sound muffler located in the general region of the end of the pipe remote from the introduction of the air and the apparatus may be enclosed in a sound insulating enclosure.

The line may be in the form of a hose for connection to the pipe. The hose may contain the valve which is preferably adjustable, for increasing the pressure and with it the temperature of the air supplied to the pipe.

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The invention is illustrated by the accompanying drawings which is a vertical section, not drawn to scale.

10 The apparatus comprises a drier 2 in the form of a desiccant dehumidifier connected to a blower 4 from which air is passed by means of hose 6 containing an adjustable valve 14 to a pipe 8 which is located in the ground 10. The blower and drier are located in a sound insulating enclosure 12. A pressure relief valve 15 (for safety reasons only) is located in the hose 6 between the blower 4 and the adjustable valve 14.

15 A sound muffling device 16 is provided at the end of the pipe remote from the point at which the air is introduced.

20 In use the apparatus is first employed to dry the inside of the pipe by connecting the hose 6 to the pipe 8 and dried air from the blower 4 passed through the pipe to remove moisture. The hose 6 is then disconnected and the pipe is lined with polymer by spraying using the apparatus disclosed in WO 97/06382. After the spraying is complete the hose 6 in which valve 14 is located is then reconnected to the pipe 8. The sound muffler 16 is placed at the remote end of the pipe 8 and dried air pumped into the pipe 8 and the valve 14 adjusted to raise the pressure inside the hose to about 0.7 bar above atmospheric. The effect is to raise the temperature of the air flowing into the pipe to about 60 to 80 degrees Centigrade.

25 The supply of the air is continued for 2 to 4 hours at the end of which time the curing of the resin is complete.

Example.

The invention is illustrated by the following Example.

5 A pipe, approximately 30cms in diameter and 100 metres in length intended for carrying water was coated internally by with Nitoline W P which is an epoxy resin sold by Fosroc Limited.

The mixture of resin and hardener was preheated before application to around 27 to 35 degrees Centigrade to facilitate pumping. and applied to the internal surface of the pipe by spraying employing the apparatus described in Patent Application
10 No. WO 97/06382.

After spraying the resin cooled to the temperature of the pipe itself which was about 7 to 10 degrees Centigrade and allowed to cure at this temperature i.e. without the application of heat. The curing was complete after approximately 16 hours.

15 Using the apparatus shown in the drawing the procedure is repeated except that, after spraying, instead of being allowed to cure under ambient conditions, the resin is heated to approximately 60 to 80 degrees Centigrade by supplying air from a Wade Blower which was obtained from Adams Ricardo Limited and providing an adjustable valve in the hose 6 connecting the blower 4 and the pipe 8
20 by means of which the pressure is increased to about 0.7 bar above atmospheric. It is found that the curing reaction is completed in between 2 and 4 hours.

CLAIMS

1. A method for forming a polymer lining inside an enclosure which method comprises applying to the internal surface of the enclosure a curable lining composition characterised in that to reduce the curing time the lining composition is heated by means of a gas which has been heated by increasing its pressure.
2. A method as claimed in claim 1 characterised in that the lining is heated to a temperature in the range 25 to 100, preferably 45 to 60 degrees Centigrade.
3. A method as claimed in claim 1 or claim 2 characterised in that the gas is heated by supplying the gas to a conduit containing a constriction.
4. A method as claimed in claim 3 characterised in that the heated gas is supplied by means of a blower, there being a line connecting the blower to the enclosure and the constriction is in the line to cause heating of the gas.
5. An apparatus for the treatment of pipes and other enclosures to accelerate the curing of a polymer lining applied to the inside of the pipe which apparatus comprises
 - (i) means for supplying air or other gas hereafter referred to as a blower
 - (ii) a line for the supply of the air from the blower to the pipe and suitable for connection to the pipe said line being connected to the blower and
 - (iii) a valve located in the line and arranged so that when air is supplied from the blower the pressure and temperature of the air inside the line is caused to increase and whereby heated air may be provided to the pipe.
6. An apparatus as claimed in claim 5 which further includes means for removing moisture from the air entering the blower.

7. An apparatus as claimed in claim 6 wherein the means for removing moisture is capable of removing at least 90%, preferably 95%, most preferably 99% of the moisture in the air entering the blower.
8. An apparatus as claimed in any one of claims 5 to 7 which is provided with a sound muffling means located in the general region of the end of the pipe remote from the introduction of the air.
9. An apparatus as claimed in any one of claims 5 to 8 wherein the apparatus is located in a sound insulating enclosure.



Application No: GB 9827210.7
Claims searched: 1-9

Examiner: Roger Binding
Date of search: 27 January 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK CI (Ed.Q): F2P (PM1, PM9, PR, PTBL); B2L (LCTA)

Int CI (Ed.6): F16L 55/165, 58/10; B05C 9/12, 9/14; B05D 7/22; B29C 63/26, 63/30, 63/34

Other: Online WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 1416947 A (TAKATA KOGYO), see page 3, lines 35 to 56.	1
X	EP 0553558 A1 (ASHIMORI INDUSTRY), see column 5, lines 22 to 46.	1
A	WO 95/16165 A1 (MCNEIL), see page 10, line 8, to page 12, line 3.	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.